Space Weather Technical Forecast

Issued on Saturday, 29 January 2022 at 00:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance G1/Minor Geomagnetic Storm and slight chance R1 Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low through the last 24 hours, with five numbered sunspot regions on the visible disc. AR2936 remains the largest and most complex (Dkc/beta), with a continued increase in growth and development in the lead portion. AR2938 has simplified to two diminishing spots. AR2934 remains unchanged. AR2937 continues to weaken and remains as Bxo/Beta. AR2935 has exhibited some minor changes to both the leading spot and its trailer portion.
No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 has fluctuated between 390-540 km/s. The density was predominantly at average levels, but temporarily reached above average levels around 28/2200 UTC. The total field strength (IMF) Bt, varied between 2-9nT. The north-south component, Bz, remained weak and variable ranging between +6nT and -8nT. Phi angle was generally positive (away from the Sun), but with some brief negative fluctuations. Geomagnetic Activity as mostly Quiet (Kp1-2), with an Active interval to end the day (Kp4).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV), was at background to moderate levels, peaking at 490 pfu at 28/1930 UTC. The associated electron fluence was below the Active threshold (1e8 integrated flux), with 1.12e7 recorded at 29/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity has been Low, with the most recent C-class originating from AR2936 in the northeast quadrant. Low activity is expected to continue, with a chance of isolated M-class flares, these again most likely from AR2936.

Solar Wind / Geomagnetic Activity: There is one CME on the Earth-Sun line that has been assessed, but currently expected to pass close to Earth around 29/0000 UTC, although a glancing impact is possible. A further weak CME may brush Earth on the 30th, but this is lower confidence. Between the potential CME arrivals, and also the influence of a slight enhancement from CH47 through today, solar winds are expected to be slightly elevated to elevated, likely peaking around 550km/s, before gradually easing to become background to slightly elevated levels through day 4 (31st). Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) increasing occasionally Active (Kp 4) today, tomorrow and during day 3 (30th) with a slight chance of G1/Minor Storm (Kp 5) intervals.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is

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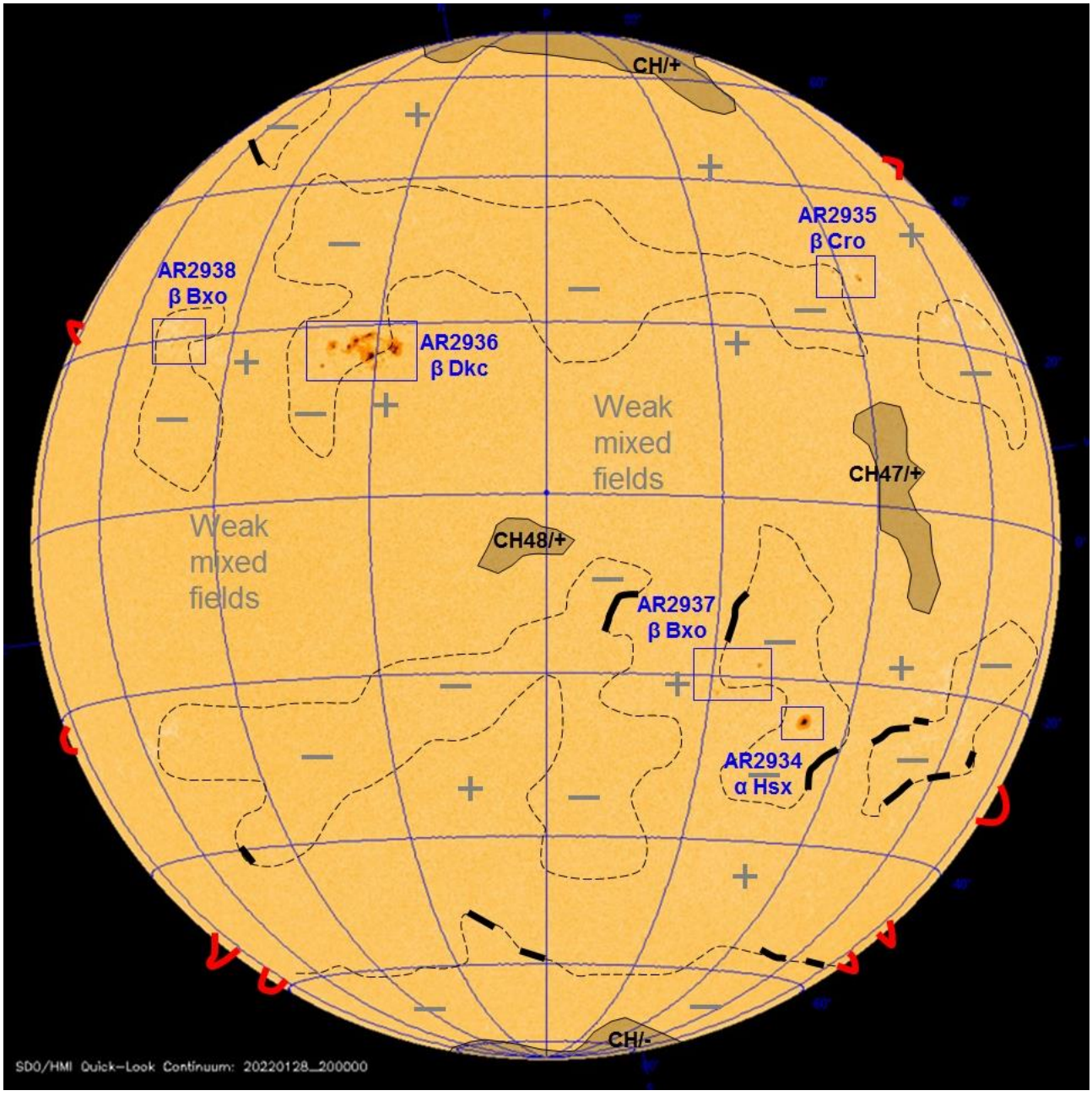
forecast to remain at background levels. The high energy electron flux (greater than 2MeV) is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially during days 3 and 4 (30th and 31st). The associated 24hr fluence is expected to remain below the Active threshold, despite an increasing trend.

Figure 1. Solar Analysis Valid 2000UTC, 28 January 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption at 26/1945 UTC, from near AR2934 generated an Earth-bound CME which could give an Earth-directed glance on the 30th. A second, probably weaker, CME may impact Earth on 31st January, although this carries low confidence.
Between the potential CME arrivals, solar winds are likely to remain slightly elevated for much of the period. This is in-line with expectations from persistence, and also timings of an enhancement seen in STEREO A PLASTIC data, although this is contaminated with a CME arrival.

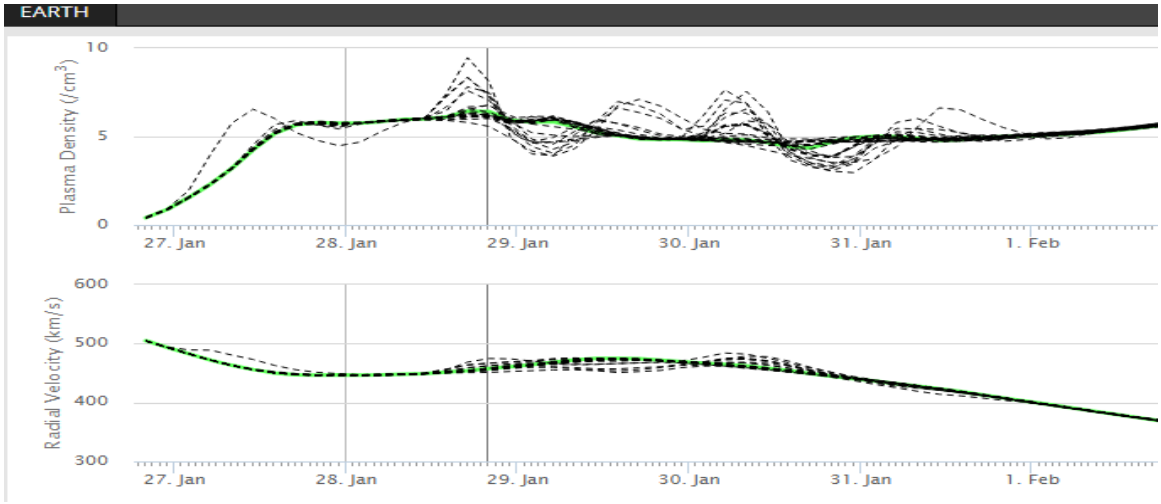
Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) with a chance of further Active intervals (Kp 4) and a slight chance of G1/Minor Storm (Kp 5) intervals throughout, although probably more likely on days 2 and 3 (30th and 31st January).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	15	15	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/0501	Partial	Filament	S23 W12	411	30/1200UTC	Low confidence of any impacts

Figure 2: Met Office ENLIL Ensemble output showing possible Earth-directed CME outcomes.



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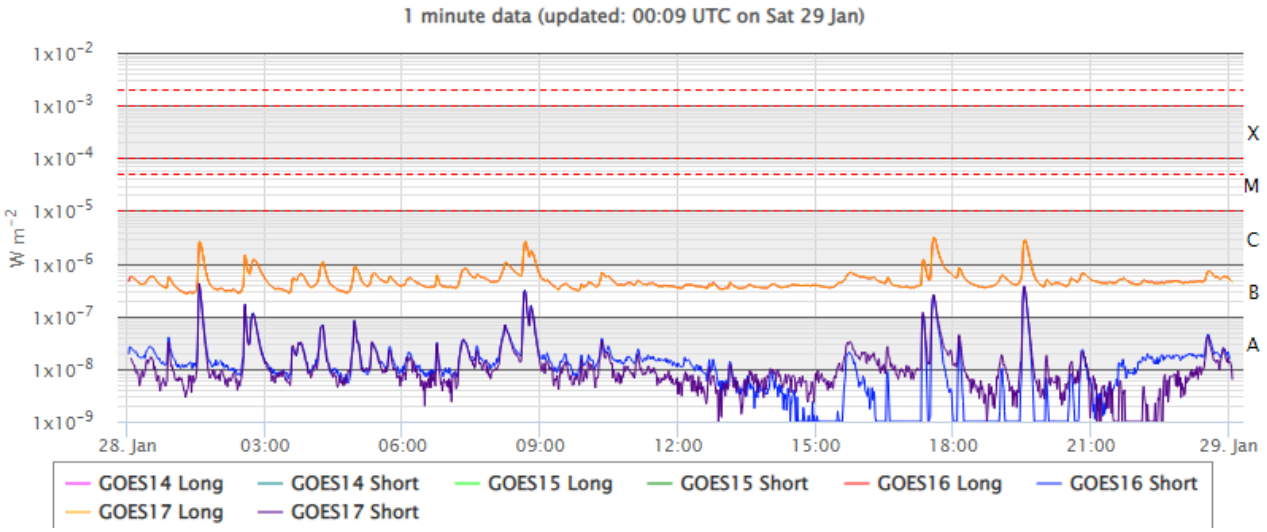
Radio Blackouts - X-Ray Flares:
Solar activity has been Low through the last 24 hours, with five numbered sunspot regions on the visible disc. AR2936 remains the largest and most complex (Dkc/beta), with a continued increase in growth and development in the lead portion and a Delta configuration remains a possibility if some merging of intermediate spots were to take place. AR2938 has simplified to two diminishing spots. AR2934 remains unchanged. AR2937 continues to weaken and remains as Bxo/Beta. AR2935 has exhibited some minor changes to both the leading spot and its trailer portion. Low solar activity is likely to continue for much of period, with a chance of isolated M-class flares, these most likely to be from AR2936.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux plot at GEO showing various C-class flares over past 24 hours.



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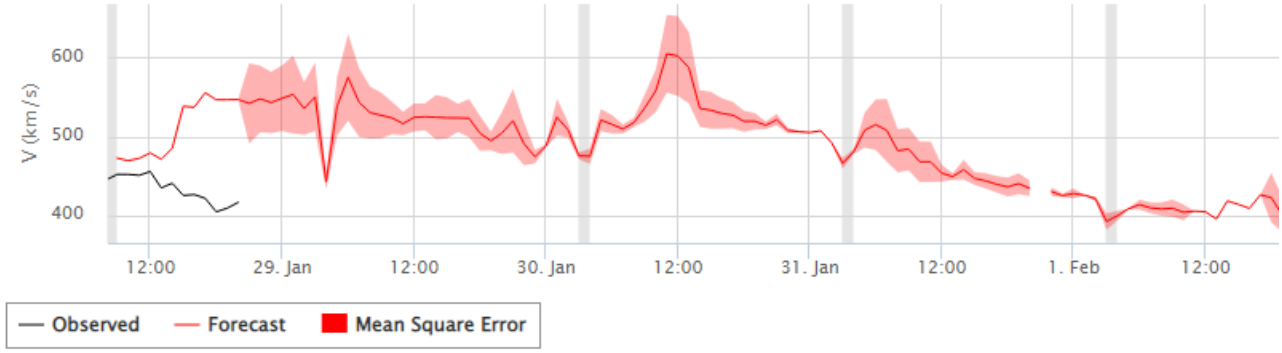
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux, as measured by GOES-16 is at background levels. No solar radiation storms are likely in the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office Solar Winds Prediction Model (SWPM) output indicating little overall change to current solar winds for the next few days.



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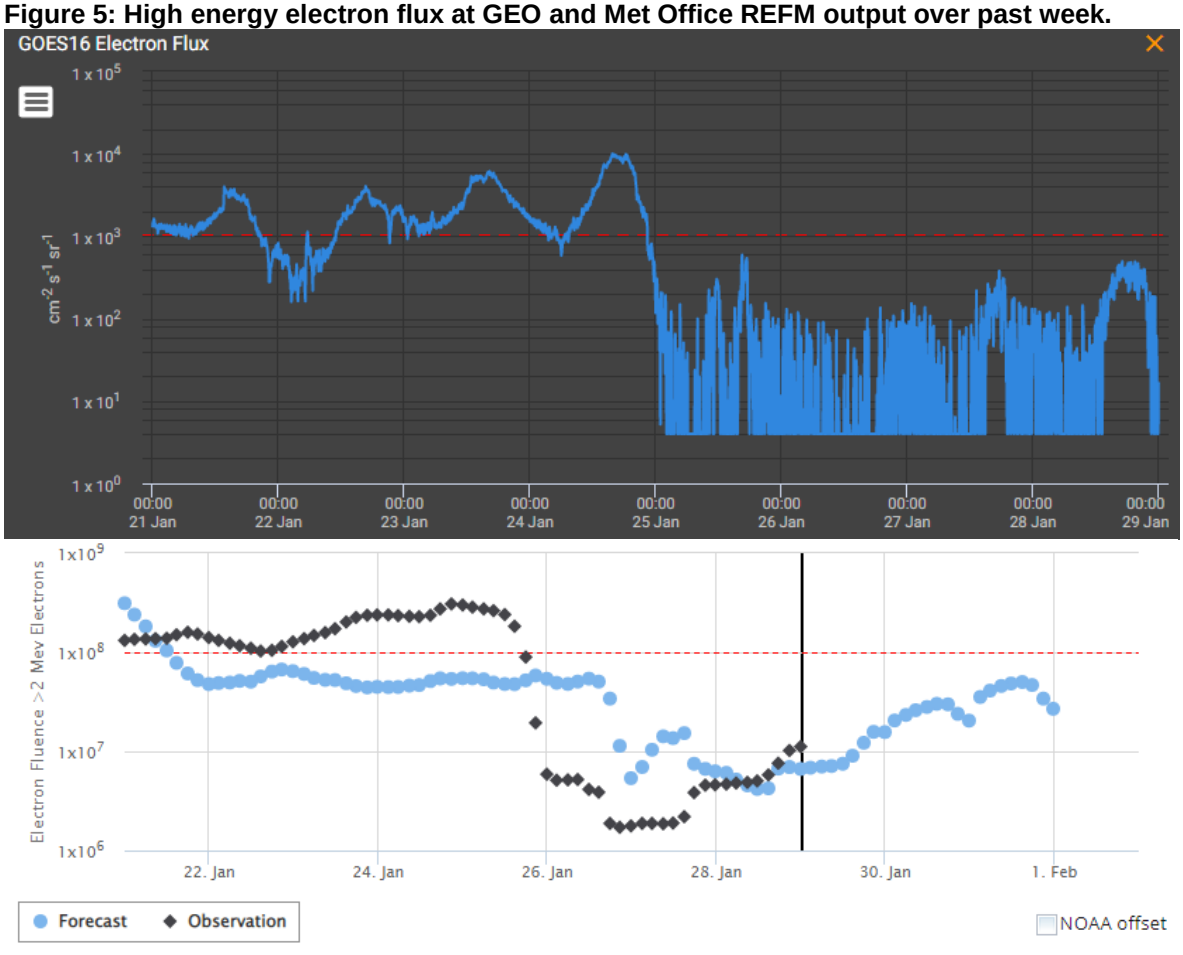
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) as observed by GOES-16 at GEO, was at background to moderate levels, peaking at 490 pfu at 28/1930 UTC during the previous 24 hours. The high energy electron flux is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially towards the end of the four day period.
With only a limited flux response anticipated from either fast wind enhancement, the associated 24hr fluence is expected to remain below the Active (1e8 integrated pfu) level despite an increasing trend. The Met Office REFM output supports fluence levels remaining below the Active period, and this is considered to be good guidance at this stage.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	30	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux at GEO and Met Office REFM output over past week.



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